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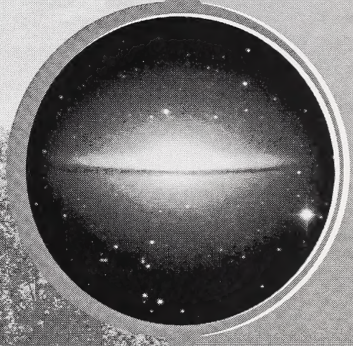
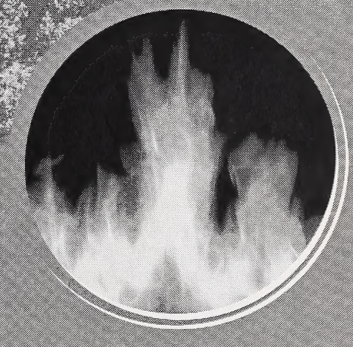
SCIENCE 9

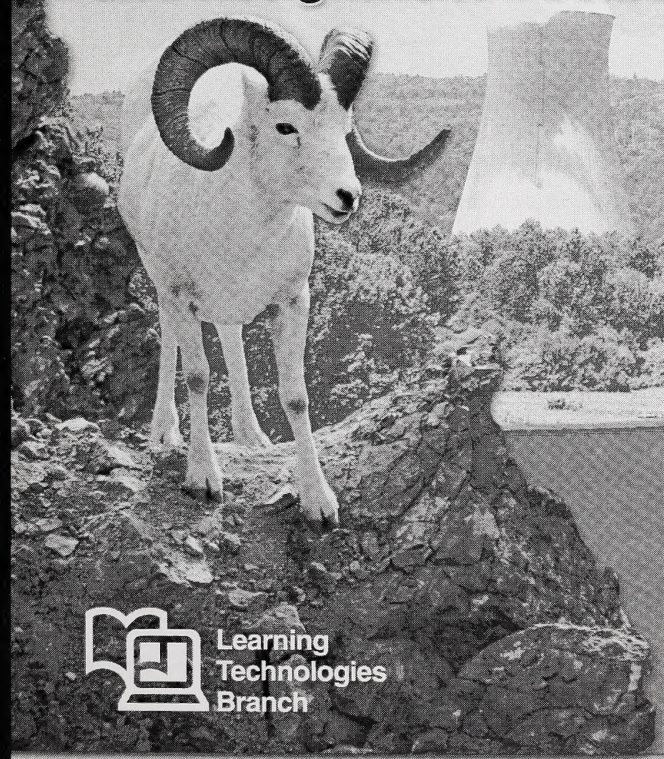
Module 3

Environmental Chemistry

Home Instructor's Guide and Assignment Booklet 3A







Learning Technologies Branch

Alberta LEARNING

Science 9
Module 3: Environmental Chemistry
Home Instructor's Guide and Assignment Booklet 3A
Learning Technologies Branch
ISBN 0-7741-2587-X

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The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Home Instructor's Guide and Assignment Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	✓
General Public	
Other	

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- Alberta Learning, **http://www.learning.gov.ab.ca**
- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
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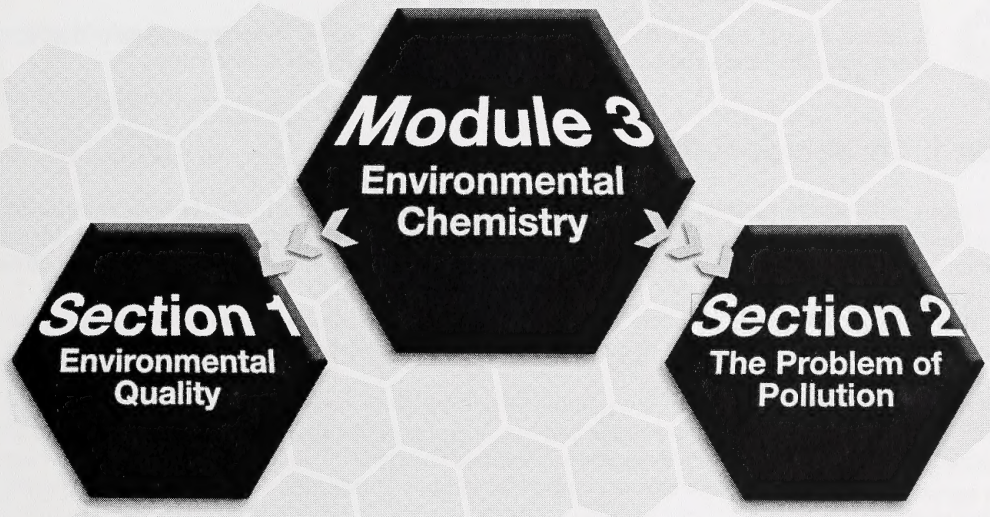
Module 3: Environmental Chemistry

The major emphasis of this module is Social and Environmental.

In this module the student investigates the role of chemical substances in the environment. In other words, the student studies the environment from a chemistry viewpoint. This contrasts with the more common biological viewpoint of the environment. Chemical substances may support or harm living things in the environment. The student finds out how to measure chemical substances in the environment. Techniques to monitor air and water quality are learned. The student also looks at ways that substances spread and then affect an environment. The student is challenged with personal and societal responsibility in dealing with environmental issues.



Assessment

The student's successful completion of all assignments in the Assignment Booklets will depend on practice obtained while doing the various activities and readings. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks is suggested in determining the student's grade for this module.

Assignment Booklet 3A	
Section 1 Assignment	66 marks
Assignment Booklet 3B	
Section 2 Assignment	37 marks
Final Module Assignment	70 marks
TOTAL	173 marks

Note that a teacher-supervised school laboratory is recommended for some investigations. Talk to the course teacher about the availability of a teacher-supervised school laboratory.

Students should have safety goggles and latex gloves for all investigations involving the manipulation of materials. Have students pay attention to all safety icons.

Section 1: Environmental Quality

This section begins with an examination of the chemical nutrients required by the human body. It then moves to the chemistry of growing the crops that provide those nutrients, and then deals with the environmental consequences of growing crops. An introduction to the acids and bases in a local environment completes the section.

The following materials will be needed to complete this section.

Section 1: Lesson 1

- safety goggles
- an apron
- latex gloves
- marking pens
- a pair of scissors
- a measuring cup or a 100-mL graduated cylinder
- four 50-mL beakers or four glasses
- a stirring rod or a spoon
- a metric ruler
- five small, self-sealing plastic bags
- paper towels
- 25 mung bean seeds or garden pea seeds
- commercial fertilizer
- graph paper

Section 1: Lesson 2

No extra materials are needed for this lesson.

Section 1: Lesson 3

- safety goggles
- a head of red cabbage
- an eye dropper
- a clean plastic straw
- baking soda
- vinegar
- a measuring cup
- coffee
- household ammonia
- a large pot (not aluminum)
- universal indicator papers and a scale
- a variety of foods and household chemicals for testing
- one or more clear, colourless containers or white soup or dessert bowls

Section 1: Lesson 4

No extra materials are needed for this lesson.

Suggested Answers

Section 1: Lesson 4

Textbook question 1 and questions 3 to 5 of "Wrap-up: Topics 1 to 3," page 212:

1. Matching terms in order from the top to the bottom of column A are the following: enzyme; acid-base neutralization; biological magnification; indicator; trace element; catalyst; pH scale; acid precipitation; poison.

3. Enzymes control essential reactions within the bodies of organisms. They allow biochemical reactions to take place faster and with less energy input.

4. DDT is a stable, non-excretable poison that bioaccumulates in fatty tissues. It breaks down very slowly in the environment, and remains in soil, air, and water for decades. DDT is biomagnified at each level of a food web. It is, however, a relatively inexpensive and very effective insecticide. Its use can significantly increase crop yields and decrease insect-borne diseases.

   Note: When DDT breaks down, it turns into DDE, which is also harmful.

5. Possible risks include the following:

   - A single crop type can deplete the soil of specific nutrients and increase the need for expensive fertilizers.
   - Monocultures are havens for species-specific pests.
   - Diseases and pests are more likely to spread and more likely to spread at a greater rate.

- Weather conditions could negatively affect a large proportion of the crops. Monocultures are fairly equally affected by environmental conditions like temperature, growing season length, or too much or too little rain.

- The crops would all need to be planted and harvested at the same time. This creates a high demand for equipment and labour for only a short time.

One benefit of planting only one crop is that specific fertilizers and pesticides can be more effective (until the pests develop resistance) and can be produced in bulk to decrease costs. Another benefit is more uniform planting and harvesting methods.

ASSIGNMENT BOOKLET 3A

Science 9
Module 3: Section 1 Assignment

Home Instructor's and Student's Comments:

STUDENT FILE NUMBER
(if label is missing or incorrect)

Date Submitted:

Apply Module Label Here

Name

Address

Postal Code

Please verify that preprinted label is for correct course and module.

FOR SCHOOL USE ONLY

Assigned Teacher:

Date Assignment Received:

Grading:

Teacher's Comments

Teacher's Signature

Home Instructor: Keep this sheet when it is returned to you as a record of the student's progress.

INSTRUCTIONS FOR SUBMITTING THIS DISTANCE LEARNING ASSIGNMENT BOOKLET

When you are registered for distance learning courses, you are expected to regularly submit completed assignments for correction. Try to submit each Assignment Booklet as soon as you complete it. Do not submit more than one Assignment Booklet in one subject at the same time. Before submitting your Assignment Booklet, please check the following:

- Are all the assignments completed? If not, explain why.
- Has your work been reread to ensure accuracy in spelling and details?
- Is the booklet cover filled out and the correct module label attached?

MAILING

1. Do **not** enclose letters with your Assignment Booklets. **Send all letters in a separate envelope.**

2. Put your Assignment Booklet in an envelope and take it to the post office and have it weighed. Attach **sufficient postage** and seal the envelope.

FAXING

1. Assignment Booklets may be faxed to the school with which you are registered. Contact your teacher for the appropriate fax number.

2. All faxing costs are the responsibility of the sender.

E-MAILING

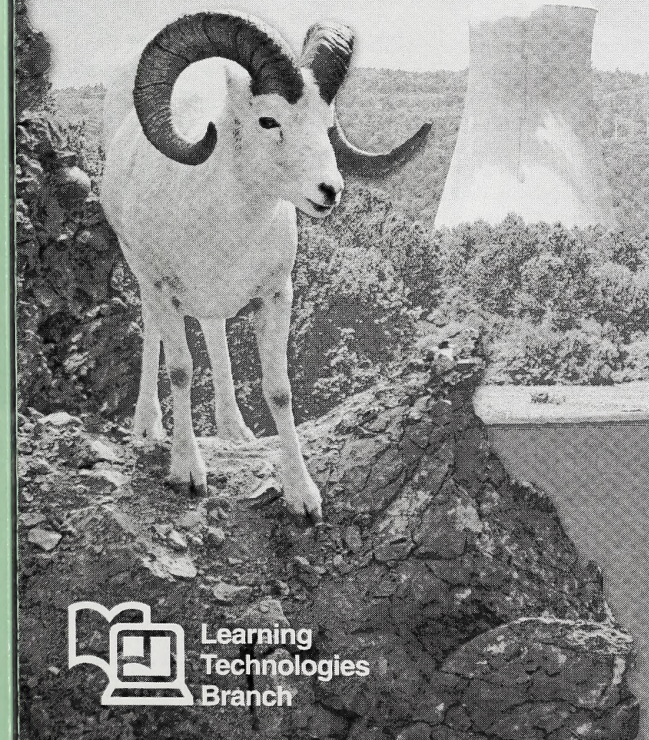
It may be possible to e-mail your completed Assignment Booklet to the school with which you are registered. Contact your teacher for the appropriate e-mail address.

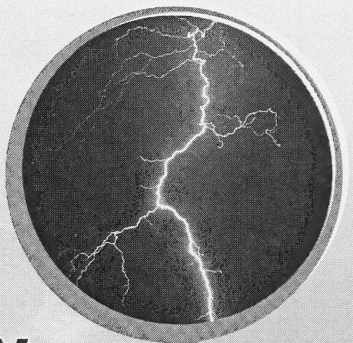
SCIENCE 9

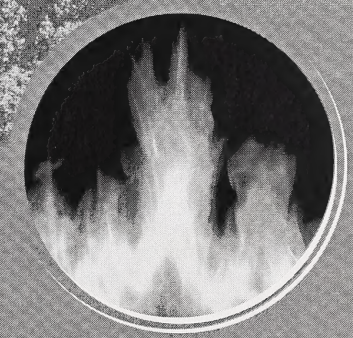
Module 3

Environmental Chemistry

Assignment Booklet 3A







Learning Technologies Branch

Alberta LEARNING

FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Section 1 Assignment	66	
	66	

Teacher's Comments

Science 9
Module 3: Environmental Chemistry
Assignment Booklet 3A
Section 1 Assignment
Learning Technologies Branch

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ASSIGNMENT BOOKLET 3A
SCIENCE 9: MODULE 3
SECTION 1 ASSIGNMENT

Your mark for this module will be determined by how well you do your assignments.

This Assignment Booklet is worth 66 marks out of the total 173 marks for the assignments in Module 3. The value of each assignment and each question is stated in the left margin.

Work slowly and carefully. If you have difficulty, go back and review the appropriate topic.

Be sure to proofread your answers carefully.

66

Section 1 Assignment: Environmental Quality

Read all parts of your assignment carefully and record your answers in the appropriate places.

5

1. As noted in Section 2 of Science 9: Module 1, a well-written hypothesis has five parts. These parts are shown in the following template.

If you _____
(increase, decrease, or change)

the _____,
(manipulated variable)

then the _____
(responding variable)

will _____
(increase, decrease, remain the same, change, or any combination of these)

because _____.
(you explain your prediction here)

Write a five-part hypothesis for "Inquiry Investigation 3A: The Effects of Fertilizer Nutrients on Seed Germination and Growth." This investigation is found on pages 183 and 184 of the textbook.

_____

_____

_____

_____

_____

(5)

2. List five controlled variables for this investigation.

_____

_____

_____

_____

_____

Return to page 17 of the Student Module Booklet and continue with Lesson 1.

(11)

3. Draw a concept map that shows relationships and roles. For your concept map, use the words *organic* and *inorganic*, and the following terms, which are boldfaced on pages 178 and 179 of the textbook.

carbohydrates	nutrients
enzymes	proteins
lipids	trace elements
macrominerals	vitamins
minerals	

Include information about these terms in your flowchart. Draw a rough sketch first; then place your final flowchart in the space provided.

Return to page 20 of the Student Module Booklet and continue with Lesson 2.

4. Refer to "Think and Link Investigation 3B: DDT in a Food Chain" on pages 189 to 191 of the textbook.

(1) **a.** There is a relationship between the trophic level of an organism and the concentration of DDT in its body. What is this relationship?

_____

_____

(1) **b.** DDT remains toxic for years and is stored in body fat. Explain why these two characteristics are undesirable in a pesticide.

_____

_____

(2) **c.** What characteristics would you want in a pesticide to make it less harmful to non-pest organisms?

_____

_____

5. Again refer to "Investigation 3B" on pages 189 to 191 of the textbook. Answer the following questions by using the data table "DDT Level in Atlantic Seabird Eggs" on page 191.

(1) **a.** There is data for two nesting sites. One nesting site is around the Bay of Fundy, while the other is along the coastline of the Atlantic Ocean. Describe the general differences between pesticide levels in bird eggs from these nesting sites.

_____

(3) **b.** Describe the changes in pesticide levels from 1972 to 1984. Also account for the changes.

_____

_____

(2)

c. Describe any differences in pesticide levels found in different species of seabirds. Suggest a reason for the differences.

Return to page 23 of the Student Module Booklet and continue with Lesson 2.

6. Consider the photograph from 1948 on page 196 of the textbook. In part, the sign on the truck reads "D.D.T. Powerful Insecticide. Harmless to Humans." Provide two reasons why the situation shown in the photograph

(2)

a. could occur in 1948

(2)

b. would not occur in Canada after 1969

Note: Be specific in your answers. Do not simply state opposites.

(3) **7.** List three ways in which home gardeners could avoid or reduce pesticide use in their yards or gardens.

_____

_____

_____

Return to page 25 of the Student Module Booklet and continue with Lesson 3.

8. Refer to "Inquiry Investigation 3F: Drop-by-Drop Neutralization" on page 208 of the textbook. Answer the following questions.

(2) **a.** Suppose more baking soda were added after neutralization occurred. What colour would the indicator turn? Why?

_____

_____

(1) **b.** What would be dangerous about swallowing too many antacid tablets?

_____

_____

(2) **c.** Which base was most effective in neutralizing acid? How does the "alkalinity" of antacid compare to the sodium hydroxide solution?

_____

_____

_____

Return to page 32 of the Student Module Booklet and continue with Lesson 3.

(4) **9.** Fish fat is responsible for that distinctive "fishy" smell and taste. What happens when you bake fish with lemon juice and onions? Be very chemically specific.

(3) **10.** Complete the following table.

Investigating pH			
Solution	**Final Colour of Blue Litmus Paper**	**Final Colour of Red Litmus Paper**	**Acidity**
1	**red**	**red**	
2	**blue**	**red**	
3	**blue**	**blue**	

11. Substances differ in their acidity or alkalinity.

(2) **a.** Which is a stronger acid—citric acid or acetic acid? Explain.

(2) **b.** Which is a stronger base—milk of magnesia (an antacid) or ammonia? Explain.

12. In an investigation, you boiled a cabbage in water. You then used this water—cabbage juice—as a pH indicator. What difficulties would you encounter if you used the cabbage juice indicator to measure the pH of

(1) **a.** orange juice

(1) **b.** bleach

_____

(1) **c.** marbles

_____

(1) **d.** butter

_____

13. Consult the acid deposition map in "Figure 3.10" on page 204 of the textbook.

a. Are emissions that lead to acid precipitation a problem in Alberta? Explain.

_____

(1)

(1) **b.** The estimated pH of the precipitation in eastern Canada is

_____.

(2) **c.** Look at the map very carefully. What is the highest acidity reading shown? Where are these readings found?

_____

(4) **14.** Eating only processed and refined foods can be dangerous to your health! Much of the natural magnesium and potassium are removed from the food during processing. List four symptoms (not roles) that could result from a diet of only processed food.

_____

_____

_____

_____

Submit your completed Assignment Booklet 3A to your teacher for assessment.
Then return to page 35 of the Student Module Booklet and begin Section 2.

ASSIGNMENT BOOKLET DECLARATIONS

The school you are registered with may require you to submit this signed form with your Assignment Booklet.

The Student's Declaration is to be signed by the student. If the student is under 16, the Supervisor's Declaration may need to be signed by the supervisor, who is usually a home instructor, teacher, or home-schooling coordinator. Failure to complete this page may invalidate the assignment results. Please contact your school and ask if this completed form is required.

STUDENT'S DECLARATION

- I have followed the instructions outlined in the Student Module Booklet.
- I have completed the activities to prepare myself for the assignments in this Assignment Booklet.
- I completed the assignments in this Assignment Booklet by myself.

_____

Student's Signature

SUPERVISOR'S DECLARATION

I hereby certify that I have supervised the learning activities completed by _____.

Student's Name

I also certify that to the best of my knowledge the assignments in this Assignment Booklet were completed independently by this student.

_____

Supervisor's Signature

If you, the student or supervisor, have any comments or observations regarding this module, write them in the following space.

_____

_____

_____

_____

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